

**Bag and Vessel Limit Analyses for the Red Grouper Regulatory Amendment
Southeast Regional Office**

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Background

The Gulf of Mexico Fishery Management Council (Council) is developing a regulatory amendment to the Reef Fish Fishery Management Plan (FMP). The regulatory amendment includes a range of alternatives for reducing the recreational harvest of red grouper by 34 to 44 percent (GMFMC 2005). Bag and size limit analyses were previously conducted to evaluate reductions in harvest resulting from lowering the bag limit or increasing the size limit (Strelcheck 2005a, 2005b). This report expands upon previous bag limit analyses and summarizes the results of vessel limit analyses, when combined with various bag limits and closed seasons.

Methods

Data sources

Landings data for Gulf of Mexico red grouper were obtained from the NMFS Marine Recreational Fisheries Statistics Survey (MRFSS) and Southeast Fishery Science Center's Headboat Survey. MRFSS intercept files and headboat catch-effort files were used to evaluate reductions in red grouper bag and vessel limits. MRFSS estimation files and headboat catch-estimate files were used to calculate landings (numbers of fish) by wave or month. Landings and catch data for 2003-2004 were used for MRFSS and headboat analyses.

Bag/Vessel Limit Analyses

The MRFSS system classifies recreational catch into three categories:

- Type A - Fish that were caught, landed whole, and available for identification and enumeration by the interviewers.
- Type B - Fish that were caught but were either not kept or not available for identification.
 - Type B1 - Fish that were caught and filleted, released dead, given away, or disposed of in some way other than Types A or B2.
 - Type B2 - Fish that were caught and released alive.

Only type A and B1 catches were used for bag and vessel limit analyses.

Some or all of the people contributing to the A catch are also interviewed to report type B catch, and those are recorded on an individual basis. If the number of people contributing to the A catch was greater than the number of people interviewed to report B1 catch, the following formula was used to account for possible under reporting of the B1 catch:

$$B1 = B1_{\text{interviewed}} \times (\text{number people in fishing party/number people interviewed to report B1 catch}).$$

On a few trips, the number of people contributing to the A+ B1 catch was less than the number of people in the fishing party. Only catches where the number of people contributing to A + B1 catch equaled the number of people in the fishing party were used for analyses, since it was unknown if additional people in the fishing party were actually fishing or participating in other activities. It was assumed the number of people in the fishing party was the same as the number of people fishing on a vessel. However, there may be multiple fishing parties per vessel, especially for larger charter vessels, which could result in underestimation of overall vessel limit reductions if not all fishing parties were interviewed.

MRFS type A + B1 catch was divided by the number of people in the fishing party to estimate the average catch per person. If type A + B1 catch per person was greater than the bag limit, the value was re-set to the bag limit ($AB1_{\text{bag limit}}$). If type A + B1 catch per vessel was greater than the vessel limit, the value was re-set to the vessel limit ($AB1_{\text{vessel limit}}$). If both the type A + B1 catch per person and per vessel were less than the bag and vessel limits, no changes to catch were made. If both the type A + B1 catch per person and per vessel were greater than the bag and vessel limits, the value was re-set to either the bag limit ($AB1_{\text{bag limit}}$) or the vessel limit ($AB1_{\text{vessel limit}}$), whichever was less. The following formulas were used to estimate harvest resulting from various combinations of bag and vessel limits:

If Type A + B1 \leq bag limit and Type A + B1 \leq vessel limit, then total harvest = A + B1

If Type A + B1 > bag limit, but less than the vessel limit, then total harvest = $AB1_{\text{bag limit}}$

If Type A + B1 \leq bag limit, but Type A + B1 > vessel limit, then total harvest = $AB1_{\text{vessel limit}}$

If Type A + B1 > bag limit and Type A + B1 > vessel limit, then total harvest = $AB1_{\text{bag limit}}$ or total harvest = $AB1_{\text{vessel limit}}$, whichever is less

Estimated harvest for headboat data was calculated in a similar manner. Catch per person was calculated by dividing the total number of fish landed by the total number of anglers on the headboat. If the catch per angler was greater than the limit ($AB1_{\text{bag limit}}$), the value was re-set to the limit, as described above. If the catch per vessel was greater than the vessel limit, the catch was reset to the vessel limit ($AB1_{\text{vessel limit}}$). If both catch per angler and catch per vessel were less than the proposed bag and vessel limits, no changes to catch were made. Similarly, if both catch per angler or catch per trip exceeded the proposed bag and vessel limits, the catch was reset to either the bag limit ($AB1_{\text{bag limit}}$), or vessel limit ($AB1_{\text{vessel limit}}$), whichever was less.

Reductions in harvest were estimated by mode by dividing the total catch exceeding a particular bag and vessel limit combination by average landings. Harvest reductions were adjusted to account for non-compliance (i.e., exceeding red grouper bag limit) by subtracting the reduction associated with a five fish bag limit from the reductions associated with a two or one red grouper limit. Compliance with the two fish bag limit was not considered since most of the data used for analysis were collected prior to implementation (July 15, 2004) of the two fish bag limit. Harvest reductions were also weighted by mode (charter, private, headboat) using 2003-2004 red

grouper landings (numbers of fish). During 2003-2004, charterboats, private vessels, and headboats accounted for 18.5, 77.2, and 4.3 percent of the recreational red grouper harvest.

Bag Limit/Vessel Limit/Closed Season Analysis

The effects of a red grouper bag limit, a red grouper vessel limit, and seasonal closures were estimated using the following equation:

$$\text{Harvest Reduction} = (\text{seasonal closure red grouper landings} + (\text{non-closure red grouper landings} \times \text{percent reduction from a } \underline{X} \text{ red grouper bag limit and } \underline{X} \text{ vessel limit}))/\text{total red grouper landings}.$$

One and two month closures were evaluated. Additionally, three closures overlapping with the existing commercial closure for red grouper, black grouper, and gag were evaluated (February 15 – March 15, February 1 – March 15, and February 15 – March 31).

Results

Table 1 summarizes reductions in red grouper harvest resulting from either a one or two red grouper bag limit combined with various vessel limits. A four red grouper vessel limit combined with a one red grouper bag limit would achieve at least a 34 percent reduction in red grouper harvest. A one or two red grouper vessel limit would be required to achieve at least a 34 percent reduction in harvest if the current red grouper bag limit of two fish per person is not changed.

Table 2 summarizes reductions in red grouper harvest resulting from a one red grouper bag limit, various vessel limits, and various seasonal closures. Table 3 summarizes reductions in harvest resulting from a two red grouper bag limit, various vessel limits, and various seasonal closures. In general, seasonal closures during late spring, summer, and early fall, combined with lower bag limits and vessel limits achieve the greatest reductions in red grouper harvest. A one red grouper bag limit combined with any vessel limit and seasonal closure would achieve at least a 30 percent reduction in red grouper harvest. A two red grouper bag limit combined with either lower vessel limits or a one or two month seasonal closures during late-spring or summer would achieve at least a 34 percent reduction in harvest.

Discussion

The analyses in this report expand upon the analyses conducted for the red grouper interim rule (Strelcheck 2005b), which did not include vessel limit analyses. Red grouper bag limit reductions estimated in this report are greater than previously estimated. These differences are a result of 1) incorporation of B1 catch data into MRFSS bag and vessel limit analyses, 2) use of 2003-2004 headboat data, and 3) weighting of harvest reductions by mode for MRFSS data. Strelcheck 2005b previously excluded B1 landings because these landings are not observed and therefore are not believed to be enforceable. However, this analysis assumes anglers would comply with the bag limit, whether or not the catch could be inspected for compliance. Headboat data for 2004 were previously unavailable for bag limit analyses conducted for the interim rule (Strelcheck 2005b), so headboat data for 2002-2003 were previously used.

Incorporation of 2003-2004 data in this report results in consistent time periods of analysis for both MRFSS and headboat data and allows for the most recent landings and catch rates to be used for determining reductions. Finally, weighting of harvest reductions by mode resulted in the greatest changes to the overall harvest reductions when compared to Strelcheck 2005b.

Previously, MRFSS and headboat harvest reductions were weighted based on the proportion of harvest for each mode. In this report, percent reductions were weighted for charter vessels, private vessels, and headboats.

As with all management measure analyses, the results of this report are dependent on several assumptions, which could affect the estimated reductions in harvest. Assumptions include: 1) no effort shifting during seasonal closures, 2) catch rates during 2003-2004 are similar to future catch rates, and 3) the number of people in a fishing party is the same as the number of people on a fishing trip/vessel. Deviation from these assumptions could increase or decrease overall reductions estimated. For instance, if fishermen increase fishing effort during open months, before or after a closed season, harvest reductions would be less than estimated. Similarly, if catch rates increase or decrease, the estimated reductions in harvest resulting from bag limits could be under or overestimated. Finally, if there is more than one fishing party on a vessel, then harvest reductions would be underestimated, especially for larger charterboats.

References

GMFMC. 2005. Regulatory amendment to the Reef Fish Fishery Management Plan to set red grouper total allowable catch and shallow-water grouper management measures for the 2006-2008 Seasons. GMFMC, Tampa, FL.

Strelcheck, A.J. 2005a. Red grouper interim rule: bag limit and seasonal closure analyses, with associated impacts on other grouper. NMFS, SERO, St. Petersburg, FL. 13 p.

Strelcheck, A.J. 2005b. Red grouper regulatory amendment and interim rule: size limit analyses. NMFS, SERO, St. Petersburg, FL. 7 p.

Table 1. Estimated harvest reductions resulting from various red grouper bag and vessel limits.

Bag Limit	Vessel Limit	Percent Reduction			
		Charter	Private	HB	All Modes
1	None	22.5	32.7	6.1	29.7
1	10	23.1	32.7	16.2	30.2
1	9	23.5	32.7	18.2	30.4
1	8	24.1	32.7	20.7	30.6
1	7	24.9	32.8	23.7	31.0
1	6	26.4	33.0	27.2	31.5
1	5	30.0	33.6	31.9	32.9
1	4	35.8	34.7	37.9	35.0
1	3	44.1	37.7	46.0	39.3
1	2	55.5	46.5	57.2	48.6
1	1	72.1	67.3	73.7	68.5
2	None	5.9	10.4	0.9	9.1
2	10	10.8	10.6	14.9	10.8
2	9	12.7	11.1	17.1	11.7
2	8	15.0	11.7	19.8	12.7
2	7	18.1	13.3	22.9	14.6
2	6	22.3	15.3	26.7	17.1
2	5	27.7	19.0	31.5	21.2
2	4	34.5	23.9	37.7	26.5
2	3	43.6	33.0	45.9	35.5
2	2	55.5	46.2	57.1	48.4

Table 2. Estimated percent reductions in red grouper harvest resulting from a one red grouper bag limit, various vessel limits, and various seasonal closures. Percentages highlighted in grey would achieve at least a 34 percent reduction in harvest.

Closed Season	Vessel Limit										
	None	10	9	8	7	6	5	4	3	2	1
None	29.7	30.2	30.4	30.6	31.0	31.5	32.8	35.0	39.3	48.7	68.5
Feb	31.9	32.5	32.6	32.8	33.2	33.7	35.0	37.1	41.2	50.3	69.5
Jan	31.9	32.5	32.6	32.8	33.2	33.7	35.0	37.1	41.2	50.3	69.5
Dec	32.5	33.0	33.2	33.4	33.7	34.2	35.5	37.6	41.7	50.7	69.7
Nov	32.5	33.1	33.2	33.4	33.8	34.3	35.6	37.7	41.7	50.7	69.7
Feb15-Mar15	33.4	34.0	34.1	34.3	34.6	35.1	36.4	38.5	42.5	51.4	70.1
Mar	34.4	34.9	35.1	35.3	35.6	36.1	37.4	39.4	43.4	52.1	70.6
Apr	34.5	35.1	35.2	35.4	35.8	36.2	37.5	39.5	43.5	52.2	70.6
Jan-Feb	34.6	35.1	35.2	35.4	35.8	36.2	37.5	39.5	43.4	52.2	70.6
Sep	34.6	35.1	35.3	35.5	35.8	36.3	37.6	39.6	43.6	52.3	70.7
Feb-Mar15	34.7	35.2	35.3	35.5	35.8	36.3	37.6	39.6	43.5	52.2	70.7
Oct	34.7	35.2	35.4	35.6	35.9	36.4	37.7	39.7	43.6	52.3	70.7
Nov-Dec	35.6	36.1	36.3	36.5	36.8	37.3	38.5	40.5	44.3	52.9	71.1
Feb15-Mar	36.0	36.5	36.6	36.8	37.1	37.6	38.8	40.8	44.6	53.2	71.2
Feb-Mar	37.2	37.7	37.8	38.0	38.3	38.8	40.0	41.9	45.7	54.1	71.8
Oct-Nov	37.8	38.2	38.4	38.6	38.9	39.4	40.5	42.5	46.2	54.5	72.1
May	38.2	38.7	38.9	39.1	39.4	39.9	41.0	43.0	46.7	55.0	72.3
Jun	38.2	38.7	38.9	39.1	39.4	39.9	41.1	43.0	46.7	55.0	72.3
Mar-Apr	39.7	40.1	40.3	40.4	40.7	41.2	42.3	44.2	47.8	55.9	72.9
Sep-Oct	39.7	40.2	40.3	40.5	40.8	41.3	42.4	44.3	47.9	56.0	73.0
Aug	40.5	41.0	41.2	41.4	41.7	42.2	43.3	45.2	48.8	56.7	73.4
Jul	40.6	41.1	41.2	41.4	41.7	42.2	43.3	45.2	48.8	56.7	73.4
Apr-May	43.3	43.7	43.9	44.0	44.3	44.8	45.8	47.6	51.0	58.6	74.6
Aug-Sep	45.6	46.0	46.2	46.3	46.6	47.1	48.1	49.8	53.1	60.4	75.6
May-Jun	47.1	47.6	47.7	47.9	48.1	48.5	49.6	51.2	54.4	61.4	76.3
Jun-Jul	49.4	49.9	50.0	50.2	50.4	50.8	51.8	53.4	56.4	63.2	77.4
Jul-Aug	51.7	52.1	52.2	52.4	52.6	53.0	54.0	55.5	58.4	64.9	78.4

Table 3. Estimated percent reductions in red grouper harvest resulting from a two red grouper bag limit, various vessel limits, and various seasonal closures. Percentages highlighted in grey would achieve at least a 34 percent reduction in harvest.

Closed Season	Vessel Limit										
	None	10	9	8	7	6	5	4	3	2	1
None	9.1	10.8	11.7	12.7	14.6	17.1	21.2	26.5	35.5	48.4	68.5
Feb	12.1	13.7	14.5	15.5	17.4	19.7	23.7	28.9	37.6	50.0	69.5
Jan	12.1	13.7	14.5	15.5	17.4	19.7	23.7	28.9	37.6	50.0	69.5
Dec	12.8	14.4	15.2	16.2	18.0	20.4	24.3	29.4	38.1	50.4	69.7
Nov	12.8	14.4	15.2	16.2	18.1	20.4	24.4	29.5	38.1	50.4	69.7
Feb15-Mar15	14.0	15.5	16.3	17.3	19.1	21.4	25.3	30.4	38.9	51.1	70.1
Mar	15.3	16.9	17.6	18.6	20.4	22.7	26.5	31.5	39.9	51.9	70.6
Apr	15.4	17.0	17.8	18.7	20.5	22.8	26.6	31.6	40.0	51.9	70.6
Jan-Feb	15.4	17.0	17.7	18.7	20.5	22.8	26.6	31.5	39.9	51.9	70.6
Feb-Mar15	15.5	17.1	17.8	18.8	20.6	22.8	26.7	31.6	40.0	52.0	70.7
Sep	15.5	17.1	17.9	18.8	20.6	22.9	26.7	31.7	40.0	52.0	70.7
Oct	15.7	17.2	18.0	18.9	20.7	23.0	26.8	31.7	40.1	52.1	70.7
Nov-Dec	16.8	18.3	19.1	20.0	21.8	24.0	27.8	32.6	40.9	52.7	71.1
Feb15-Mar	17.2	18.7	19.5	20.4	22.2	24.4	28.1	33.0	41.2	52.9	71.2
Feb-Mar	18.8	20.3	21.0	21.9	23.6	25.8	29.5	34.2	42.3	53.8	71.8
Oct-Nov	19.6	21.0	21.8	22.6	24.4	26.5	30.2	34.9	42.8	54.2	72.1
May	20.2	21.7	22.5	23.4	25.1	27.2	30.8	35.5	43.4	54.7	72.3
Jun	20.2	21.7	22.5	23.4	25.1	27.2	30.8	35.5	43.4	54.7	72.3
Mar-Apr	22.0	23.4	24.1	25.0	26.6	28.7	32.3	36.8	44.6	55.6	72.9
Sep-Oct	22.1	23.6	24.3	25.1	26.8	28.9	32.4	37.0	44.7	55.7	73.0
Aug	23.3	24.8	25.5	26.3	28.0	30.0	33.5	38.0	45.6	56.4	73.4
Jul	23.3	24.8	25.5	26.3	28.0	30.1	33.5	38.0	45.6	56.5	73.4
Apr-May	26.7	28.1	28.8	29.6	31.1	33.1	36.4	40.7	48.0	58.4	74.6
Aug-Sep	29.8	31.1	31.8	32.6	34.1	36.0	39.1	43.2	50.2	60.1	75.6
May-Jun	31.7	33.0	33.6	34.4	35.9	37.7	40.8	44.8	51.6	61.2	76.3
Jun-Jul	34.8	36.0	36.6	37.3	38.7	40.5	43.4	47.3	53.7	63.0	77.4
Jul-Aug	37.7	38.9	39.5	40.2	41.5	43.2	46.0	49.7	55.8	64.7	78.4

Addendum

During the August 2005 Gulf of Mexico Fishery Management Council (Council) meeting, the Council asked staff to evaluate differential vessel limits for vessels with a U.S. Coast Guard Certificate of Inspection (COI). Federal regulations require vessels with a passenger capacity of seven passengers or greater to possess a COI. All headboats surveyed by the SEFSC's Headboat Survey carry 7 passengers or more and therefore must possess a COI. There are also some vessels in the MRFSS intercept files that carry seven passengers or more and therefore would be required to possess a COI.

Analyses were conducted to evaluate the effects of a one red grouper bag limit and three red grouper vessel limit for non-COI vessels (private and some charter vessels) and a vessel limit of one red grouper per two or per three paying passengers for COI vessels (headboats and some charter vessels). Methods for bag and vessel limit analyses were the same as those described previously with the following modifications: 1) MRFSS intercepts were categorized by passenger capacity (6 passengers or less = non-COI, 7 passengers or greater = COI), 2) reductions for MRFSS vessels assumed to have a COI and for all headboats were calculated using vessel limits of one red grouper per two or per three paying passengers, and 3) charter vessel reductions were weighted by the proportion of landings in the MRFSS intercept files accounted for by COI versus non-COI vessels (67.4 percent COI, 32.6 percent non-COI). For MRFSS intercepts, it was assumed that no vessels possessing a COI were carrying less than seven passengers.

Results

Tables 1 and 2 summarize the results of these analyses. Implementing a vessel limit of one red grouper per two paying passengers on COI vessels and a one red grouper bag limit and three red grouper vessel limit on non-COI vessels would reduce harvest by approximately 37 percent. Increasing the vessel limit on COI vessels to one red grouper per three paying passengers would reduce overall harvest by an additional 2 percent.

Table 1. Estimated reduction in harvest resulting from a one red grouper bag limit and three red grouper vessel limit for non-COI vessels and a vessel limit of one red grouper per two paying passengers for COI vessels.

Bag/Vessel Limit	Mode	Reduction
1 bag, 3 vessel	Private	37.7
1 bag, 3 vessel	Charter Non-COI	42.5
1 bag per 2 paying passengers	Charter-COI	34.9
1 bag per 2 paying passengers	Headboat	14.7
	Weighted Reduction	37.2

Table 2. Estimated reduction in harvest resulting from a one red grouper bag limit and three red grouper vessel limit for non-COI vessels and a vessel limit of one red grouper per three paying passengers for COI vessels.

Bag/Vessel Limit	Mode	Reduction
1 bag, 3 vessel	Private	37.7
1 bag, 3 vessel	Charter Non-COI	42.5
1 bag per 3 paying passengers	Charter-COI	48.0
1 bag per 3 paying passengers	Headboat	41.7
	Weighted Reduction	39.1